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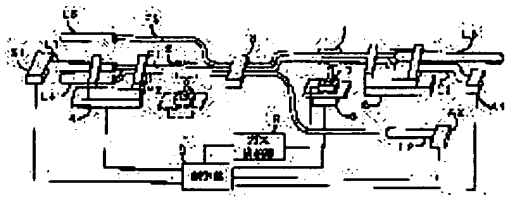
(54) METHOD OF MANUFACTURING MULTIPLEXER AND DEMULTIPLEXER AND DEVICE THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To widen a band width of a wavelength separation degree by fixing one point of three optical fibers beforehand, bundling two of the optical fibers respectively, and fusion-extending by using a micro burner.
SOLUTION: Three optical fibers F1-F3 are fixed at one point by using a fixing shaft 3. The optical fibers F1 and F2 are bundled at one end on an optical source side and clamped on an extension stage 4, and the optical fibers F1 and F3 are bundled at the other end on a photo-receptor side and clamped on an extension stage 5. When the two closely adhered and fused optical fibers F1, F3 are collectively extended, a micro burner 7 is moved (vibrated) about at a half moving speed of the extension stage 5, for fusion-extension. When the two closely adhered and fused optical fibers F1, F2 are collectively extended, the micro burner 7 is moved (vibrated about at a half moving speed of the extension stage 4, for fusion-extension.



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CLAIMS

[Claim(s)]
[Claim 1] The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, In manufacturing the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass Fix at least three optical waveguides in the piece place, and two optical waveguides are combined collectively and clamped in the end of said optical waveguide. The manufacture approach of the optical multiplexer/demultiplexer unit characterized by clamping two optical waveguides collectively in the combination which contains one of said two clamped optical waveguides in the other end of said optical waveguide, and carrying out melting extension of the two optical waveguides of each combination.
[Claim 2] The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, A fixed means to be equipment which manufactures the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass, and to fix at least three optical waveguides in the piece place, The 1st clamp means which combines collectively and clamps two optical waveguides in the end of said optical waveguide, The 2nd clamp means which clamps two optical waveguides collectively in the combination which contains one of said two clamped optical waveguides in the other end of said optical waveguide, The manufacturing installation of the optical multiplexer/demultiplexer unit characterized by having the heating extension means which carries out melting extension of the two optical waveguides of each combination.
[Claim 3] The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, In manufacturing the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass Two optical waveguides are combined collectively and clamped in the end of said optical waveguide. The manufacture approach of the optical multiplexer/demultiplexer unit characterized by clamping two optical waveguides collectively in the combination which contains one of said two clamped optical waveguides in the other end of said optical waveguide, and carrying out melting extension of the two optical waveguides of each combination.

[Claim 4] The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, The 1st clamp means which is equipment which manufactures the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass, and combines collectively and clamps two optical waveguides in the end of said optical waveguide, The 2nd clamp means which clamps two optical waveguides collectively in the combination which contains one of said two clamped optical waveguides in the other end of said optical waveguide, The manufacturing installation of the optical multiplexer/demultiplexer unit characterized by having the heating extension means which carries out melting extension of the two optical waveguides of each combination.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of the optical multiplexer/demultiplexer unit which can carry out the wavelength division multiplex of the information signal with which the manufacture approach of an optical multiplexer/demultiplexer unit and its manufacturing installation were started, especially the going-up circuit differed from the plurality to which get down and a circuit is made to transmit, and its manufacturing installation.
[0002]
[Description of the Prior Art] Conventionally, in order to make the information signal of varieties, such as a telephone, television, and data, transmit, the wavelength division multiplex (wavelength div-ision multiplexing, WDM) method put on one optical fiber using two or more wavelength is adopted, and this wavelength division multiplex is performed by optical multiplexer/demultiplexer equipment.
[0003] Such optical multiplexer/demultiplexer equipment consists of optical multiplexer/demultiplexers 55 which intercept the signal of the wavelength lambda1 and lambda2 of two pieces about each wavelength lambda1 and lambda2, and are passed between one optical waveguide 52 and two optical waveguides 53, and 54, as shown in drawing 6 . Thus, in the constituted optical multiplexer/demultiplexer equipment 51, if the light of the wavelength lambda1 and lambda2 of two pieces is inputted into input port 55a of an optical multiplexer/demultiplexer 55 by the input port power P11 The output port power P13 outputted to output port 55b' of the optical multiplexer/demultiplexer 55 connected to one waveguide 53 of two optical waveguides 53 and 54 and the output port power P14 outputted to output port 55b of the optical multiplexer/demultiplexer 55 connected to the waveguide 54 of another side P13=P11* (1+cos (deltaphi))/2 .... (1)
P14=P11* (1-cos (deltaphi))/2 .... (2)
It becomes. Here, deltaphi is taken as the phase contrast in the mode of the light of wavelength lambda 1, and the light of wavelength lambda 2.
[0004] Therefore, when wavelength lambda 1 is set to 1.31 micrometers and wavelength lambda 2 is set to 1.55 micrometers, as the relation between the output port power P13 with a wavelength of 1.55 micrometers and the output port power P14 with a wavelength of 1.31 micrometers, and wavelength is shown in drawing 7 , it turns out theoretically that it becomes a sine wave. Moreover, as shown in drawing 8 , as for bandwidth, wavelength degree of separation are theoretically set to

21.6nm by -23dB.
[0005]
[Problem(s) to be Solved by the Invention] However, with such optical multiplexer/demultiplexer equipment 51, since the bandwidth of wavelength degree of separation was small, there was a possibility that wavelength might interfere. The optical multiplexer/demultiplexer equipment to which two-piece series connection of the above optical multiplexer/demultiplexers was carried out to such a difficulty is proposed. For example, if series connection of input port 61a of the 1st optical multiplexer/demultiplexer 61 and the 2nd input port 71 is carried out as shown in drawing 9 (a), the wavelength of 1.31 micrometers of two pieces and the 1.55-micrometer signal which are inputted into input port 61a of the 1st optical multiplexer/demultiplexer 61 will be separated spectrally with the 1st optical multiplexer/demultiplexer 61, and a signal with a wavelength of 1.55 micrometers will be inputted into waveguide 30 through the 2nd optical multiplexer/demultiplexer 71. According to this optical multiplexer/demultiplexer equipment 100, as the output port P23 of output port 71' of the 2nd optical multiplexer/demultiplexer 71 is shown in drawing 10 , bandwidth in case wavelength degree of separation are -23dB is theoretically set to 81.6nm.
[0006] Moreover, if series connection of the 1st optical multiplexer/demultiplexer 81 and 2nd optical multiplexer/demultiplexer 91 is carried out as shown in drawing 9 (b), the wavelength of 1.31 micrometers of two pieces and the 1.55-micrometer signal which are inputted into input port 81a of the 1st optical multiplexer/demultiplexer 81 will be separated spectrally with the 1st optical multiplexer/demultiplexer 81, and a signal with a wavelength of 1.31 micrometers will be outputted to waveguide 40 through the 2nd optical multiplexer/demultiplexer 91. According to this optical multiplexer/demultiplexer equipment 100', as the output port power P24 of output port 91b' of the 2nd optical multiplexer/demultiplexer 91 is shown in drawing 10 , bandwidth in case wavelength degree of separation are -23dB is theoretically set to 81.6nm.
[0007] However, it may be unable to be satisfied with the bandwidth of such wavelength degree of separation of optic fiber communication. It was made in order that this invention might cancel such a difficulty, and it aims at offering the manufacture approach of the optical multiplexer/demultiplexer unit which can improve bandwidth of wavelength degree of separation large conventionally using the unit of the optical multiplexer/demultiplexer which fused the optical fiber and was unified, and its manufacturing installation.
[0008]
[Means for Solving the Problem] The manufacture approach of the optical multiplexer/demultiplexer unit of this invention which cancels such a difficulty The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, In manufacturing the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass Fix at least three optical waveguides in the piece place, and two optical waveguides are combined collectively and clamped in the end of optical waveguide. Two optical waveguides are collectively clamped in the combination containing one of two optical waveguides clamped in the other end of optical waveguide, and melting extension of the two optical waveguides of each combination is carried out.

[0009] Moreover, the manufacturing installation of the optical multiplexer/demultiplexer unit of this invention The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, A fixed means to be equipment which manufactures the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass, and to fix at least three optical waveguides in the piece place, The 1st clamp means which combines collectively and clamps two optical waveguides in the end of optical waveguide, It has the 2nd clamp means which clamps two optical waveguides collectively in the combination containing one of two optical waveguides clamped in the other end of optical waveguide, and the heating extension means which carries out melting extension of the two optical waveguides of each combination.
[0010] Moreover, other manufacture approaches of the optical multiplexer/demultiplexer unit of this invention The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, In manufacturing the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass Two optical waveguides are combined collectively and clamped in the end of optical waveguide. Two optical waveguides are collectively clamped in the combination containing one of two optical waveguides clamped in the other end of optical waveguide, and melting extension of the two optical waveguides of each combination is carried out.
[0011] Moreover, other manufacturing installations of the optical multiplexer/demultiplexer unit of this invention The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, The 1st clamp means which is equipment which manufactures the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass, and combines collectively and clamps two optical waveguides in the end of optical waveguide, It has the 2nd clamp means which clamps two optical waveguides collectively in the combination containing one of two optical waveguides clamped in the other end of optical waveguide, and the heating extension means which carries out melting extension of the two optical waveguides of each combination.
[0012] In the manufacture approach of the optical multiplexer/demultiplexer unit of this invention, and its manufacturing installation The signal of the wavelength of at least two pieces about each wavelength between one optical waveguide and at least two optical waveguides Cutoff, In manufacturing the optical multiplexer/demultiplexer unit multiplexed and separated spectrally with the optical multiplexer/demultiplexer to pass The ** which does not fix or fix three optical fibers connected to optical waveguide, Two optical fibers are combined collectively and clamped by the end of three optical fibers. Two optical fibers are collectively clamped in the combination containing one of two optical fibers clamped in the other end of the above-mentioned optical fiber, and melting extension of the two optical fibers of each combination is carried out.
[0013]
[Embodiment of the Invention] Hereafter, the manufacture approach of the optical multiplexer/demultiplexer unit of this invention and one example of the manufacturing installation are explained with reference to a drawing. As shown in

drawing 1 , it is the wavelength of 1.31 micrometers of two pieces from the light source S1. Between the optical waveguide L1 which transmits the 1.55-micrometer signals lambda1 and lambda2, and two optical waveguides L2 and L3 connected to electric eyes A1 and A2 It intercepts on each above-mentioned wavelength of 1.31 micrometers, and each wavelength of the 1.55-micrometer signals lambda1 and lambda2. In manufacturing an optical multiplexer/demultiplexer unit as shown in drawing 2 which consists of two optical multiplexer/demultiplexers 1 and 2 which are made to multiplex and separate spectrally by making it pass, and by which series connection is carried out The optical fiber F1 connected between the optical waveguide L1 produced from the light source S1, and the optical waveguide L3 by the side of an electric eye, The optical fiber F2 connected between the optical waveguide L4 by the side of the light source, and the optical waveguide L2 by the side of an electric eye, The optical fiber F3 connected with the optical waveguide L5 by the side of the light source between optical waveguide L6 by the side of an electric eye, The fixed shaft 3 which fixes the piece place of the three above-mentioned optical fibers F1, F2, and F3, The extension stage 4 which clamps an optical fiber F1 and an optical fiber F2 collectively by the end which is a light source side, The micro burner 7 which it is installed the extension stage 5 which clamps an optical fiber F1 and an optical fiber F3 collectively by the other end which is an electric-eye side, and on the movable base 6, and is lit by the gas supply from the gas supply section 8, and the control section 9 which controls above-mentioned each part, respectively are formed.

[0014] Thus, the manufacture approach of the optical multiplexer/demultiplexer unit of this invention constituted and one example of the manufacturing installation are explained with reference to the flow chart Fig. shown in drawing 4 . The piece place of three optical fibers F1, F2, and F3 is fixed using the fixed shaft 3 (step 100). The optical fiber F1 and optical fiber F2 which are connected to the optical waveguide L1 which transmits the wavelength of 1.31 micrometers of two pieces, and the 1.55-micrometer signals lambda1 and lambda2 from the light source S1 It bundles up by the end which is a light source side, and it clamps on the extension stage 4 (step 101), and an above-mentioned optical fiber F1 and an above-mentioned optical fiber F3 are put in block by the other end which is an electric-eye side, and it is made to clamp on the extension stage 5 (step 102). At this time, the other end which is the electric-eye side of an optical fiber F2, and the end which is the light source side of an optical fiber F3 are respectively fixed with the suitable means.

[0015] In manufacturing an optical multiplexer/demultiplexer 1 as the 1st process, by the extension stage 5 side, (step 103), and an above-mentioned optical fiber F1 and an above-mentioned optical fiber F3 are stuck so that there may be no sag, and they are welded rather than the fixed shaft 3 with the micro burner 7 lit by a control section 9 and the gas supply section 8 (step 104). Next, the extension stage 5 is operated to an electric-eye side through a control section 9, and in case the two above-mentioned optical fibers F1 and F3 by which welding was carried out are made to extend collectively, when movable [of the micro burner 7] (vibration) is carried out and it carries out melting extension at about 1/2 rate of the working speed of the extension stage 5, (step 105) and an optical multiplexer/demultiplexer 1 can be manufactured (step 106).

[0016] In order to carry out melting extension of the optical fibers F1 and F2 in

manufacturing an optical multiplexer/demultiplexer 2 as the 2nd process, the micro burner 7 is moved through a control section 9 between the extension stages 4 where the fixed shaft 3 and optical fibers F1 and F2 bundle up, and are clamped (step 107). Like the time of the above-mentioned optical multiplexer/demultiplexer 1 manufacture, using the lit micro burner 7, optical fibers F1 and F2 are stuck so that there may be no sag, and they are welded by the extension stage 4 side rather than the fixed shaft 3 (step 108).

[0017] Next, the extension stage 4 is operated to a light source side through a control section 9, and in case the two above-mentioned optical fibers F1 and F2 by which welding was carried out are made to extend collectively, when movable [of the micro burner 7] (vibration) is carried out and it carries out melting extension at about 1/2 rate of the working speed of the extension stage 4, (step 109) and an optical multiplexer/demultiplexer 2 can be manufactured (step 110). Moreover, although the optical multiplexer/demultiplexer unit by which each optical multiplexer/demultiplexers 1 and 2 were packed was manufactured in **** in order of manufacture of the optical multiplexer/demultiplexer 1 by the side of the electric eye in the 1st process, and manufacture of the optical multiplexer/demultiplexer 2 by the side of the light source in the 2nd process, the order of the above-mentioned process does not ask.

[0018] By therefore, the optical multiplexer/demultiplexer unit as shown in drawing 2 by which the optical multiplexer/demultiplexers 1 and 2 manufactured from the 1st and 2nd process were packed The wavelength of 1.31 micrometers of two pieces which optical waveguide L1 and an optical fiber F1 transmit from the light source S1, The signal lambda 1 with a wavelength of 1.31 micrometers inputted into the input-side port of an optical multiplexer/demultiplexer 2 among the 1.55-micrometer signals lambda1 and lambda2 is passed from one output side port of an optical multiplexer/demultiplexer 2. The 1.31-micrometer signal lambda 1 makes this 1.55-micrometer signal lambda 2 separate spectrally, and is made to transmit to an electric eye A2 through optical waveguide L2 by making it intercept by passing the 1.55-micrometer signal lambda 2 from the output side port of another side of an optical multiplexer/demultiplexer 2. Moreover, an optical fiber F1 transmits a signal lambda 4 and the signal lambda 1 with a wavelength of 1.31 micrometers without cutoff ***** with an optical multiplexer/demultiplexer 2. The above-mentioned signal lambda 4 by being inputted into the input-side port of an optical multiplexer/demultiplexer 1, being intercepted, and being separated spectrally through optical waveguide L3 from one output port of an optical multiplexer/demultiplexer 1 an optical fiber F1 It is possible to transmit only the signal lambda 1 with a wavelength of 1.31 micrometers to an electric eye A1 through the output port and optical waveguide L3 of another side of an optical multiplexer/demultiplexer 1.

[0019] Moreover, although the wavelength of 1.31 micrometers of two pieces and the 1.55-micrometer signals lambda1 and lambda2 which are transmitted through the optical waveguide L1 from the light source S1 were made to separate spectrally through the optical multiplexer/demultiplexers 1 and 2 which constitute an optical multiplexer/demultiplexer unit and each signals lambda1 and lambda2 were made to transmit to electric eyes A1 and A2 in the above-mentioned, it can use also for multiplexing of the signal transmitted through optical waveguide from two or more light sources.

[0020] Although made the piece place of three optical fibers F1, F2, and F3 fix beforehand, two optical fibers F1 and F2, and F1 and F3 were made put in block, respectively and melting extension was carried out in the above-mentioned example using the micro burner 7 as other examples of this invention, not fixing the piece place of three optical fibers F1, F2, and F3 with the fixed shaft 3 (except for step 100), as shown in drawing 3 In the end of an optical fiber, combine two optical fibers F1 and F2 collectively, and it clamps on the extension stage 4. The same effectiveness is done so by putting in block two optical fibers F1 and F3 in the combination containing one of two optical fibers with which the above-mentioned was clamped in the other end of an optical fiber, making it clamp on the extension stage 5, and carrying out melting extension with the same means as ****.

[0021] Each optical multiplexer/demultiplexer of the optical multiplexer/demultiplexer unit manufactured by the manufacturing installation of such an optical multiplexer/demultiplexer unit can have cutoff center frequency different, respectively. In addition, it has checked that bandwidth was set to 89.7nm by wavelength degree of separation in -23dB as the result of having measured the bandwidth of wavelength degree of separation when only a frequency predetermined in cutoff center frequency was shifted to height, respectively, and it was set up, therefore only 20nm of cutoff center frequency was shifted to height in this optical multiplexer/demultiplexer unit, respectively and it was set up is shown in drawing 5 .

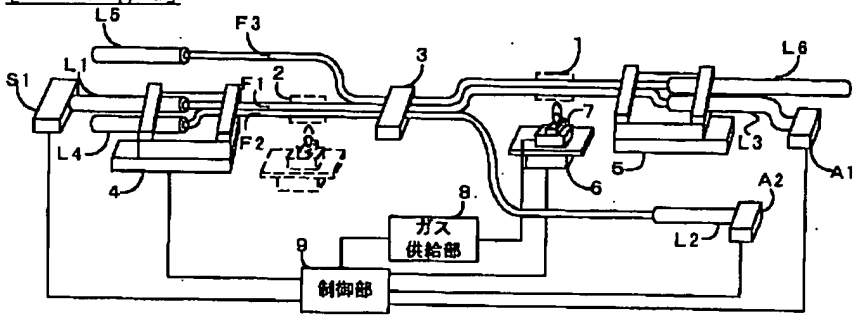
[0022]

[Effect of the Invention] According to the manufacture approach of the optical multiplexer/demultiplexer unit of this invention, and its manufacturing installation, bandwidth of wavelength degree of separation was able to be made larger than before for the optical multiplexer/demultiplexer unit of a configuration so that the signal of the wavelength of at least two pieces may be intercepted and passed about each wavelength with two optical multiplexer/demultiplexers between one optical waveguide and at least two optical waveguides by the manufacturing installation so that clearly from the above explanation. Moreover, since an optical property can be excellent and a manufacturing cost can also be lowered compared with the thing using a dielectric multilayers filter or a microoptics component, it is available to a WDM optical transmission device, the terminal using WDM transmission, etc.

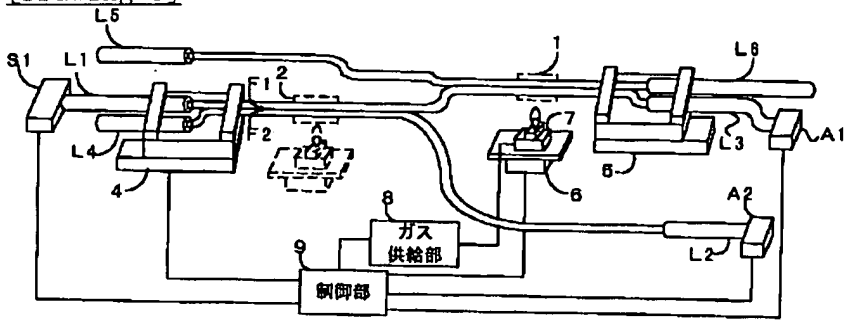
[Translation done.]

DRAWINGS

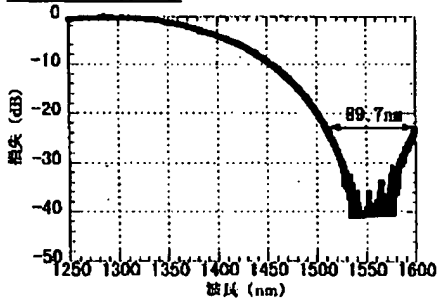
[Drawing 1]



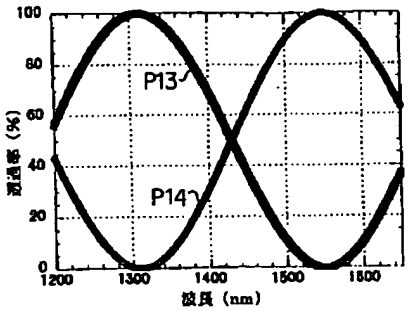
[Drawing 3]



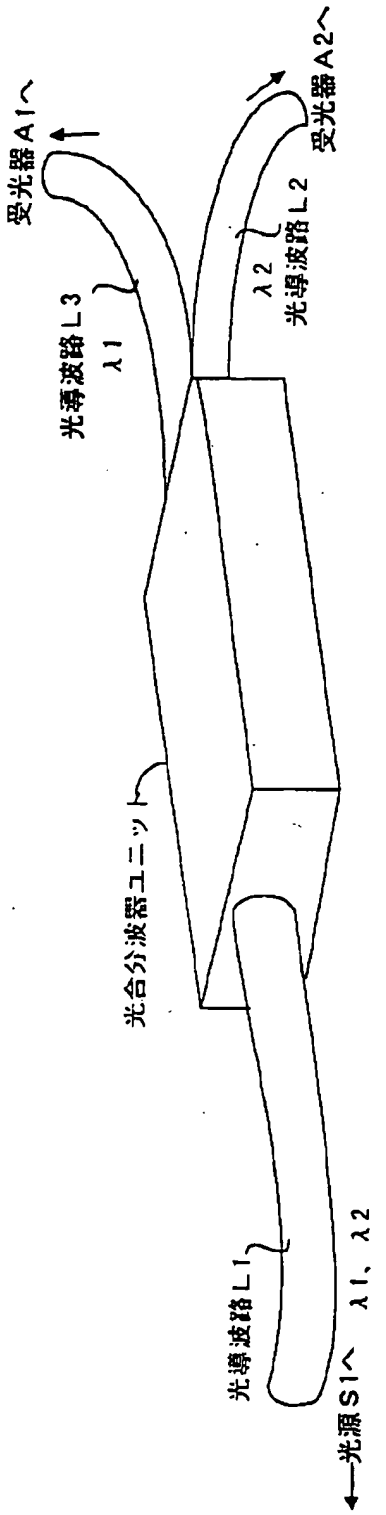
[Drawing 5]



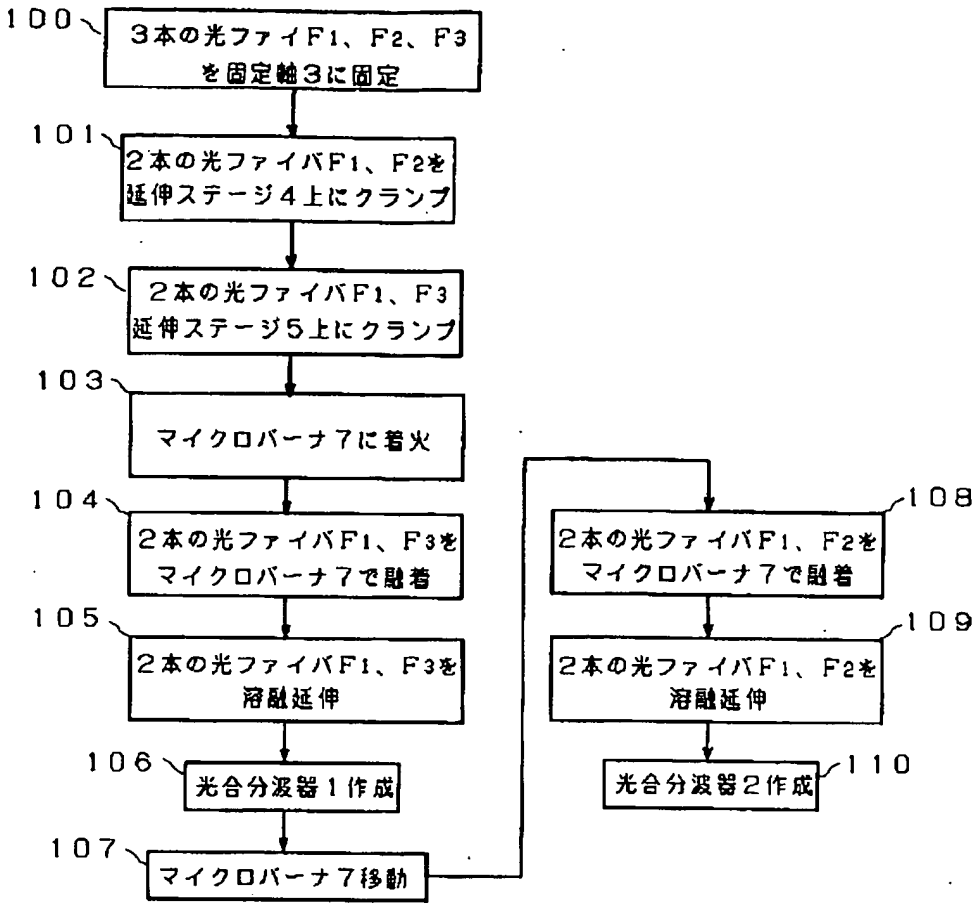
[Drawing 7]



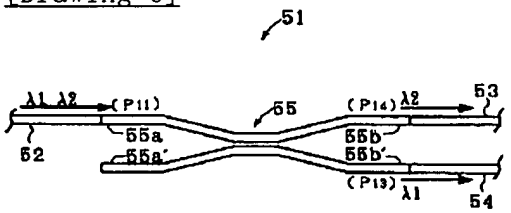
[Drawing 2]


受光器A1へ
受光器A2へ
光導波路L3
λ1
λ2
光導波路L2
光合分波器ユニット
光導波路L1
λ1、λ2
光源S1へ

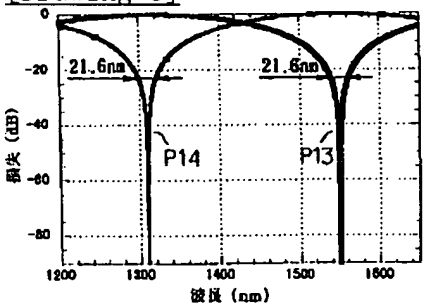
[Drawing 4]



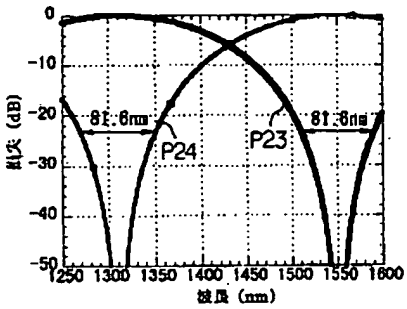
[Drawing 6]



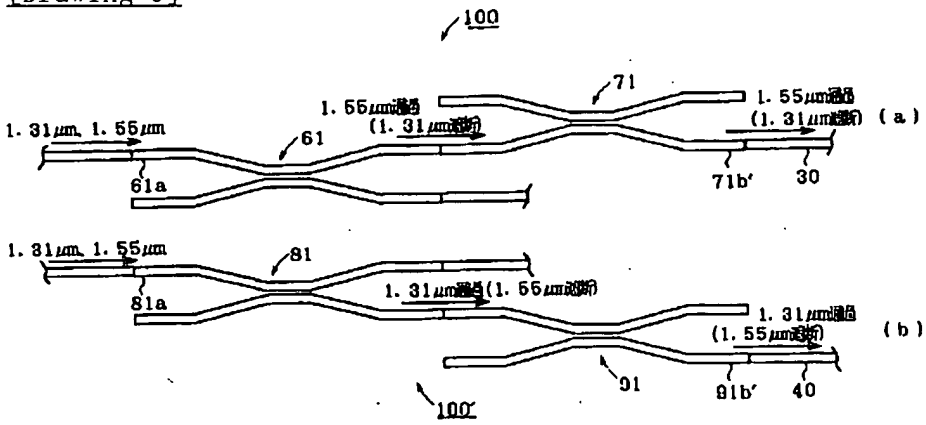
[Drawing 8]



[Drawing 10]



[Drawing 9]



[Translation done.]